FIG. 1

FCPA block diagram

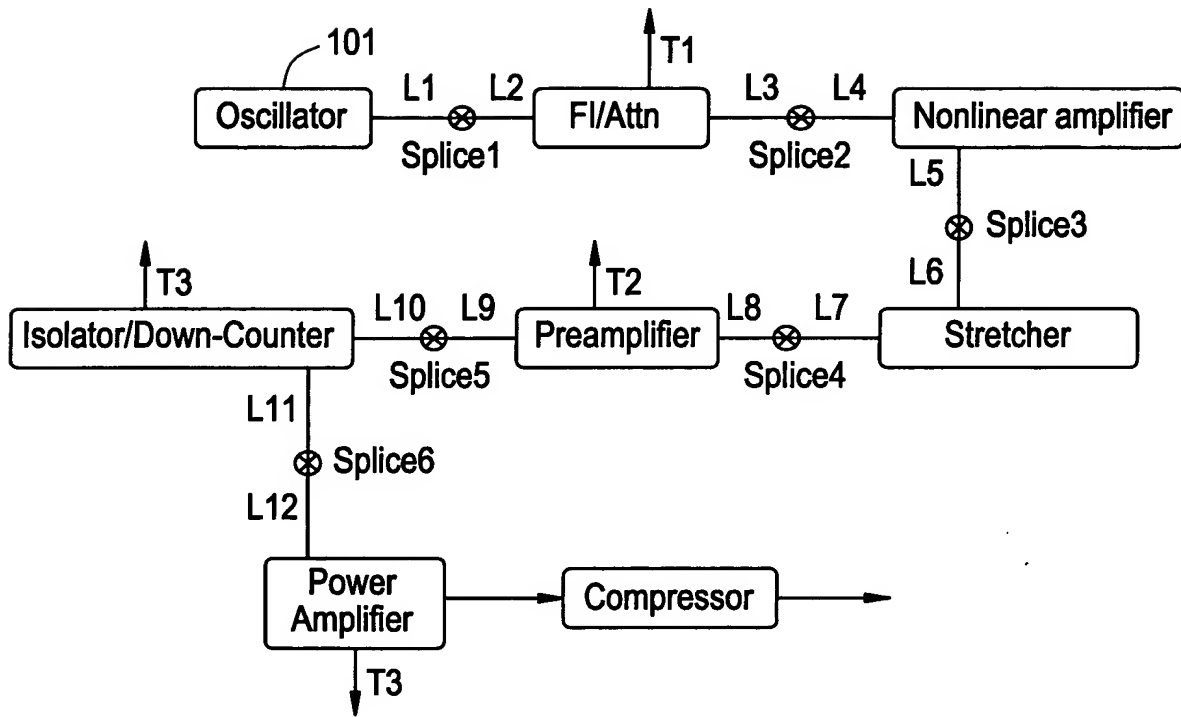# FIG. 1A
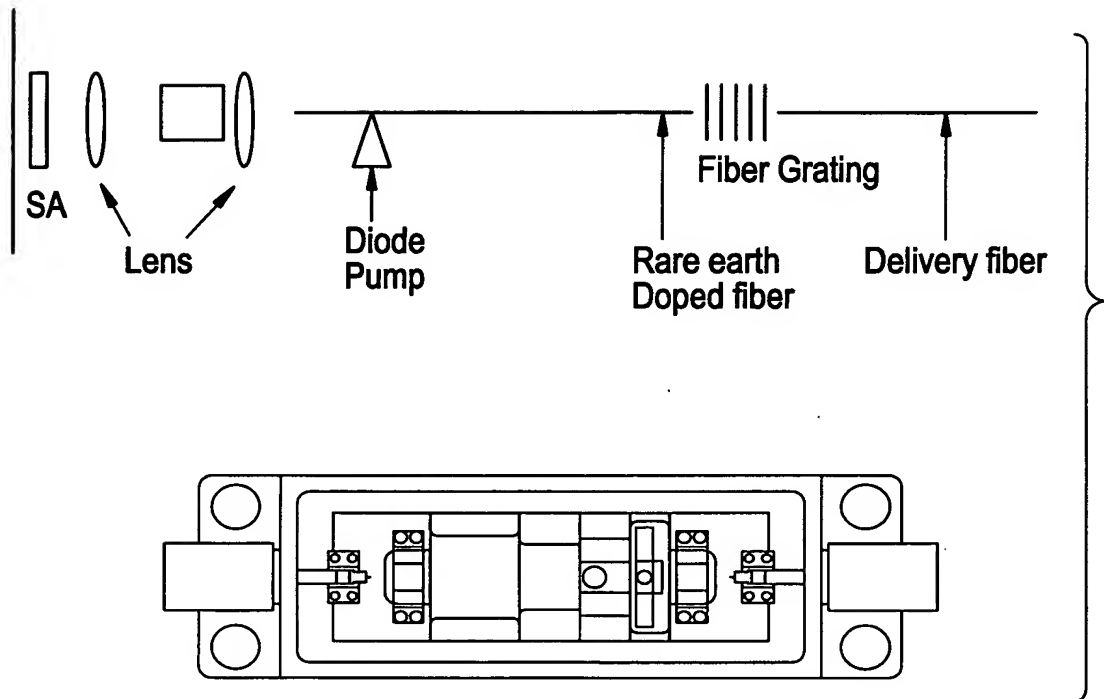

SA

Lens

Diode
Pump

Rare earth
Doped fiber

Fiber Grating

Delivery fiber

FIG. 1B

FIG. 1C

Input

output

Pump diode

FIG. 2

Attenuator Module

Fiber #1 (Input) → Collimating Lens → Polarizer → Halfwave plate, rotatable → Focusing Lens → Fiber #2 (Output)

Pigtailed Tap Points

Fiber #1 (Input) → Collimating Lens → Small Isolator → Pickoff plate → TBO → Output 2: Output → Focusing Lens → Fiber #2 (Output)1
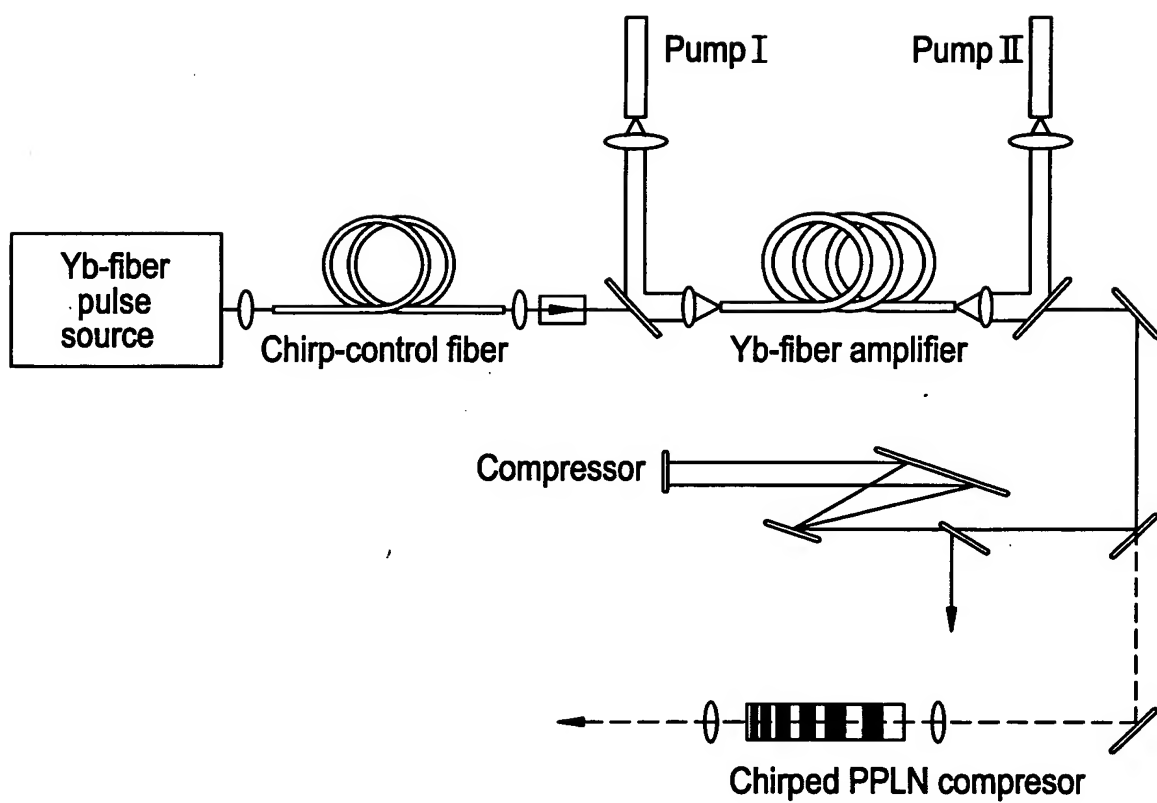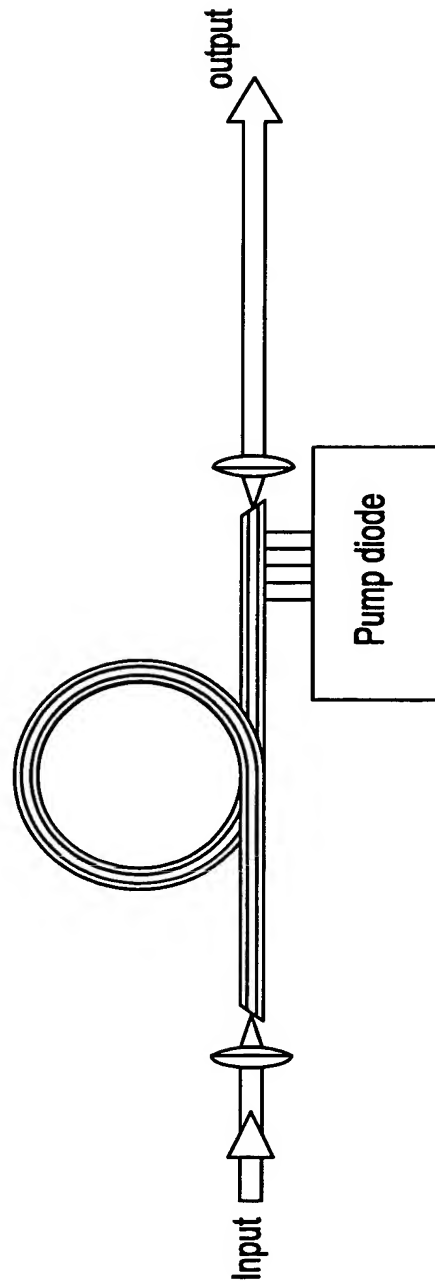
FIG. 3

Optical Layout for Down counter module

Input Fiber

Collimating Lens
360

Focusing Lens
370

AO Modulator
350

Collimating Lens
380

Focusing Lens
390

Output Fiber

Waveplate

325
Pick- off Window

335
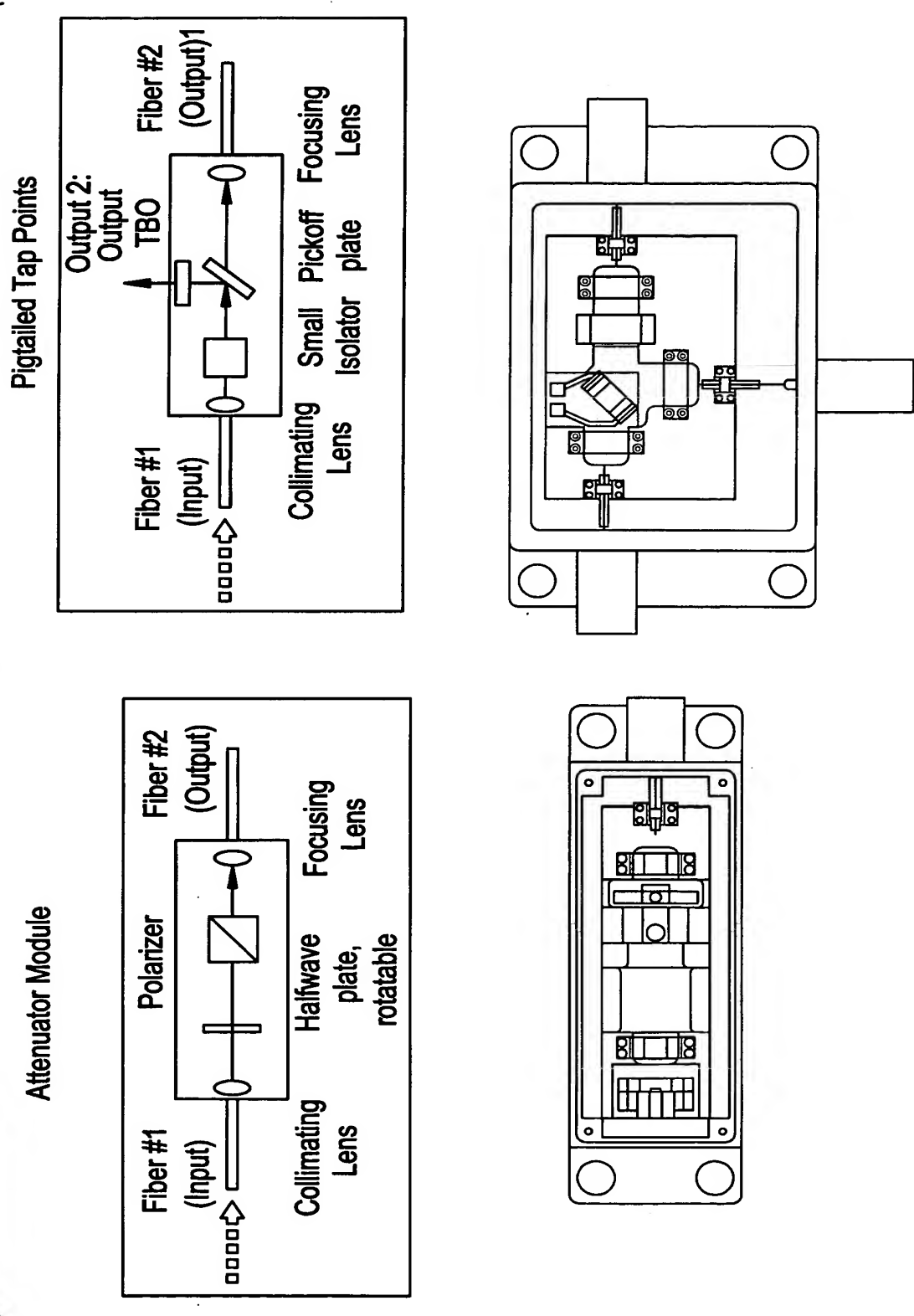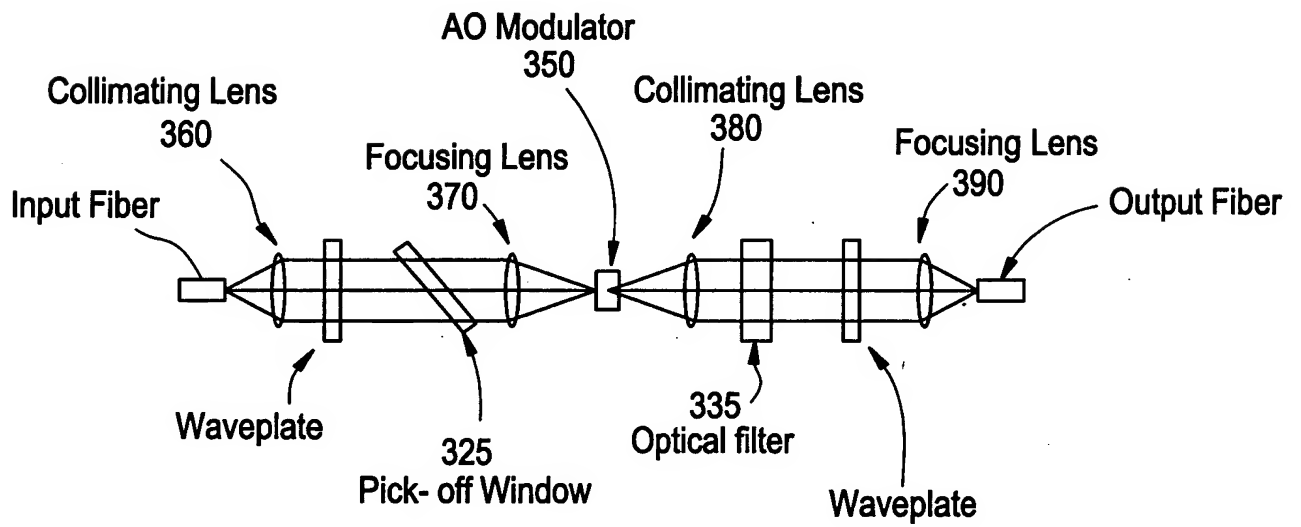Optical filter

Waveplate

FIG. 4

Temporal performance of down counter
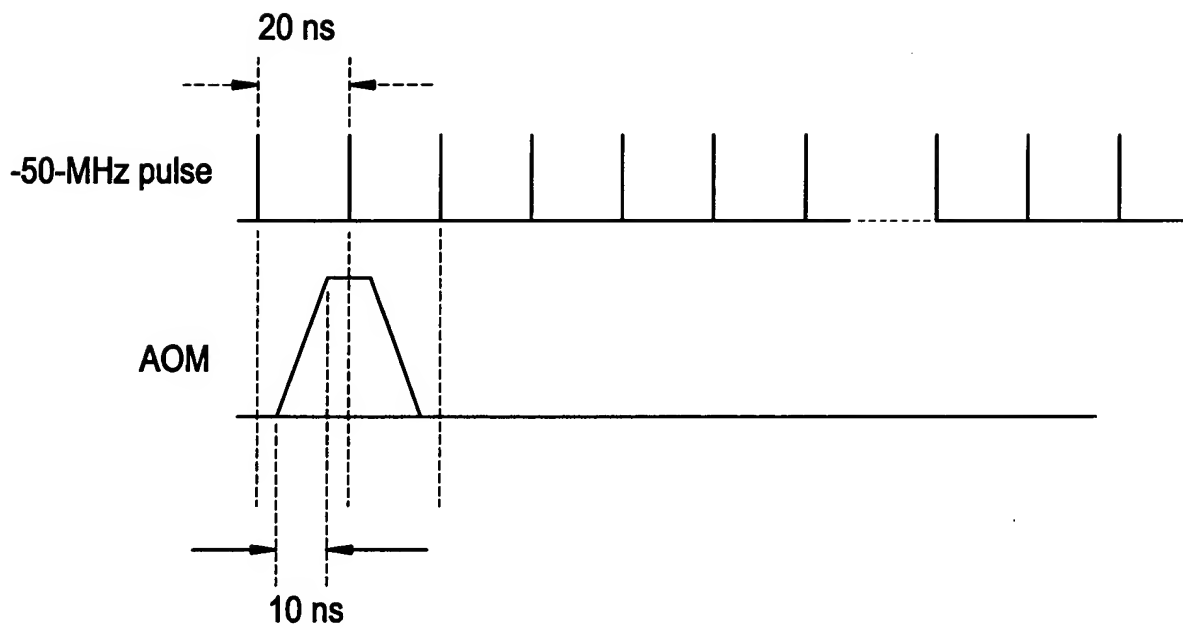
FIG. 5A

Spectrum from oscillator and
after first filter, isolator and attenuator module
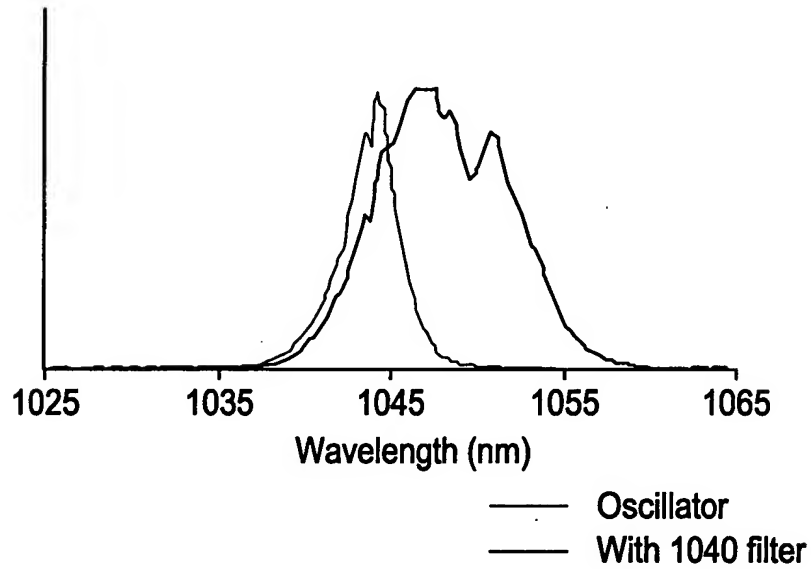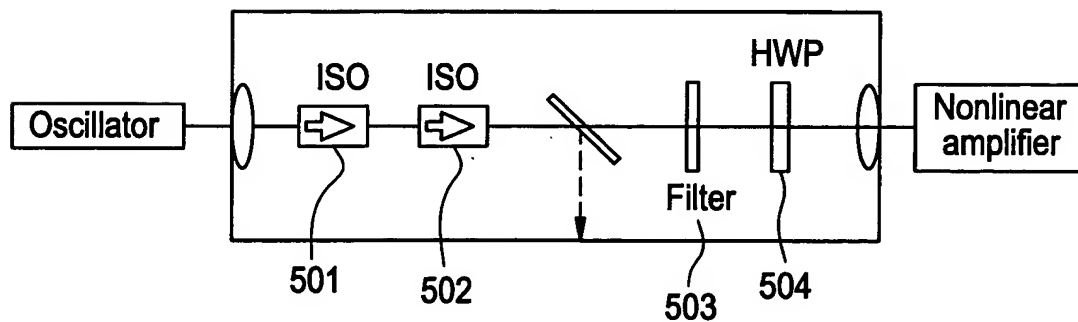

Wavelength (nm)

—— Oscillator
—— With 1040 filter

FIG. 5B

Component illustration of
filter, isolator and attenuator module

FIG. 6A

Spectrum from nonlinear amplifier as a
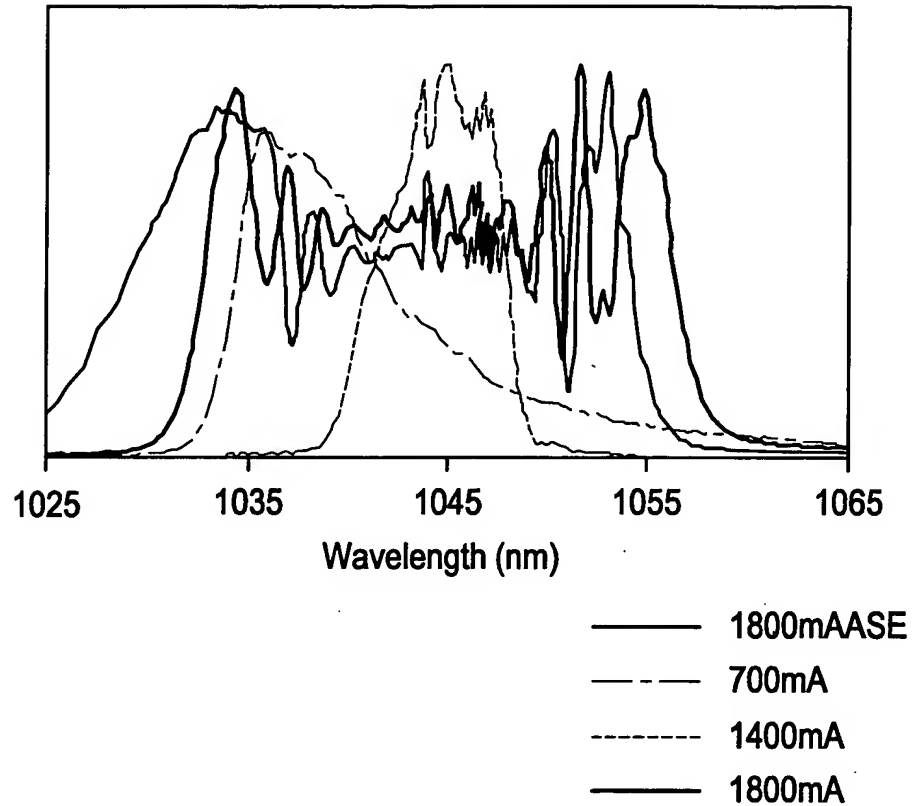function of pump diode current and ASE
spectral output at peak current

Wavelength (nm)

——— 1800mAASE

—·—— 700mA

--------- 1400mA

——— 1800mA

FIG. 6B

Component illustration of isolator -attenuator module between
nonlinear amplifier and stretcher

Nonlinear Amplifier

ISO

HWP

Polarizer

HWP
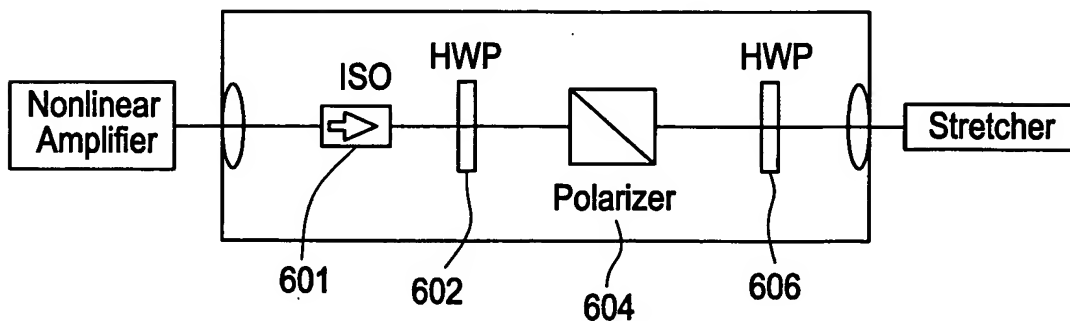
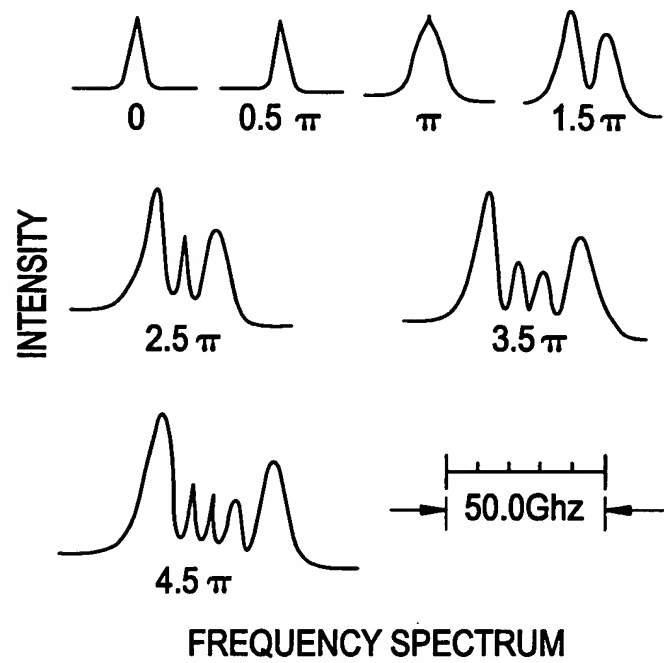Stretcher

601   602   604   606

FIG. 7

Spectrum of pulses with self-phase
modulation propagating in a positive dispersion fiber

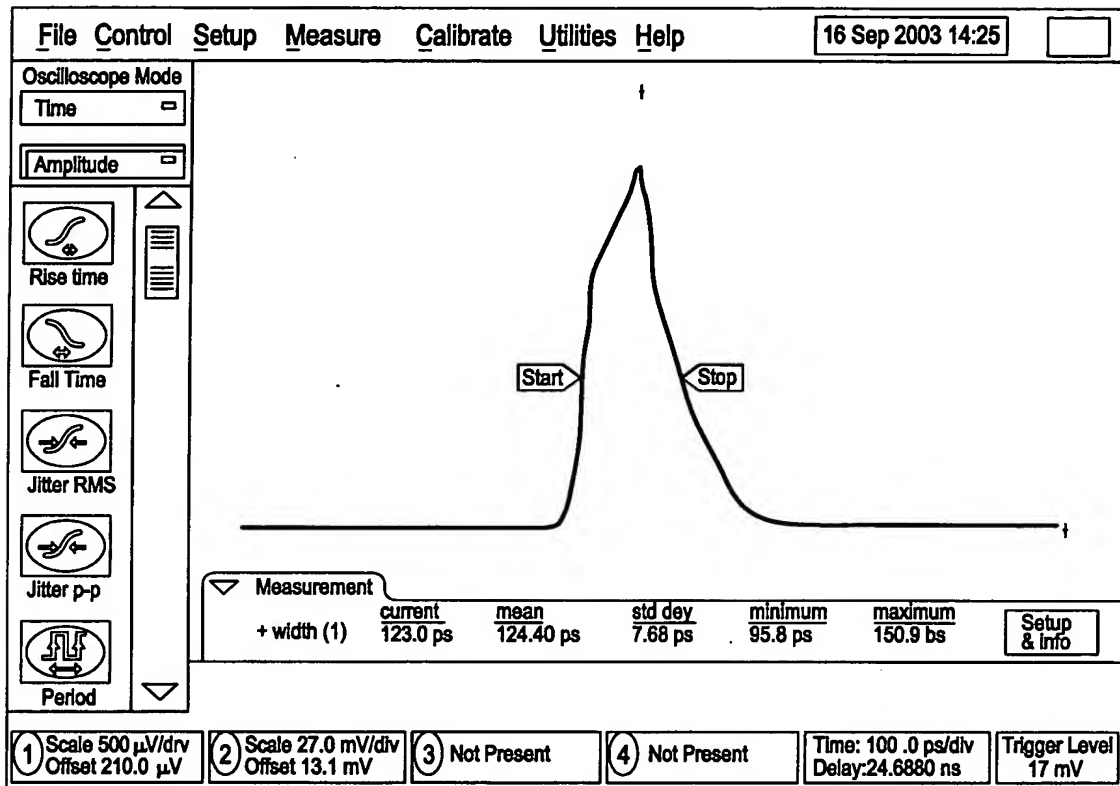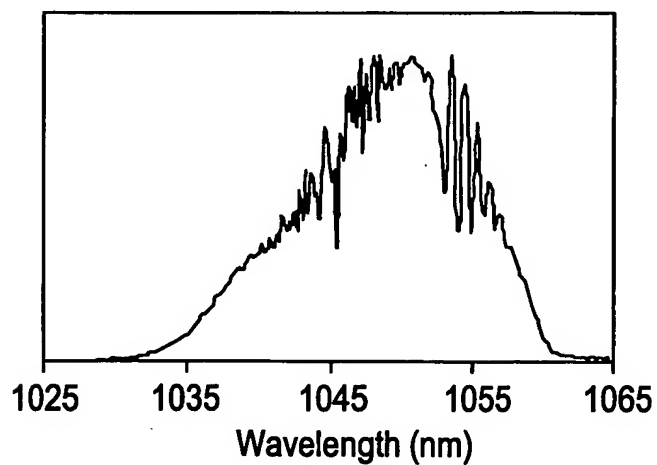FREQUENCY SPECTRUM

FIG. 8A

Temporal profile of the pulse after stetcher

FIG. 8B

Spectral profile of the pulse after stetcher

FIG. 9

Spectrum after power amplifier

Wavelength (nm)
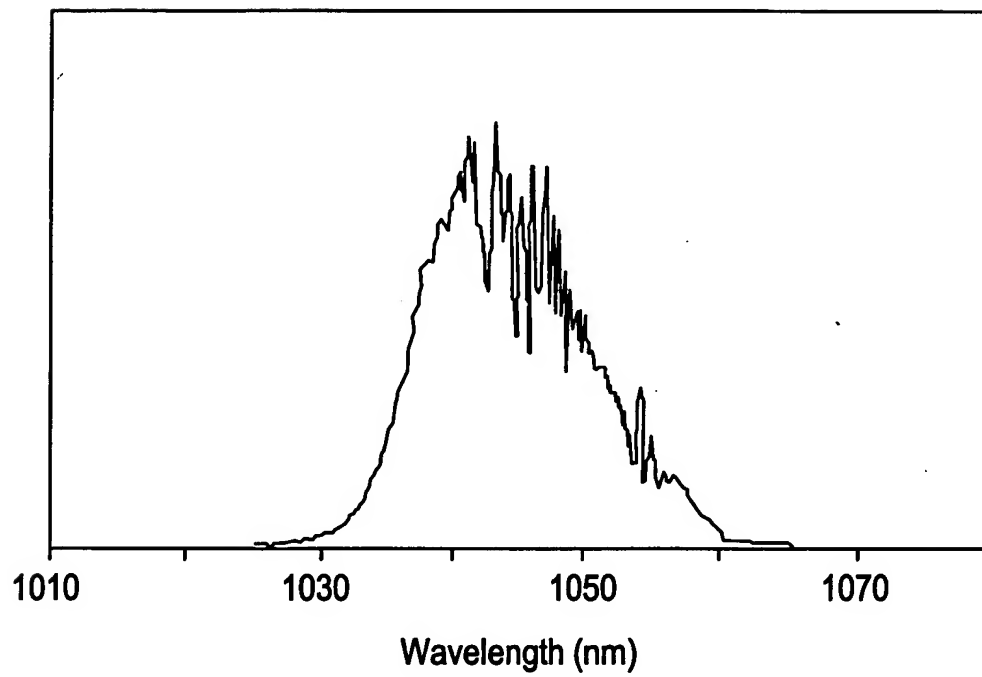
FIG. 10A

Auto correlations of output pulse 5 ps range

HARDCOPY

output to

Int. Printer
Card
Flpy
GP1B
RS232

B Average (1)
1ms
1.00 V
2.816 V
173 swps

Page feed

Off   On

B

protocol

HP 7470
HP 7550
TIFF
TIFF compr.
BMP

Time   0 μs

1 ms
1 1 V DC   2 DC 4.04 V
2 2 V DC   no limits set   ☐ Normal
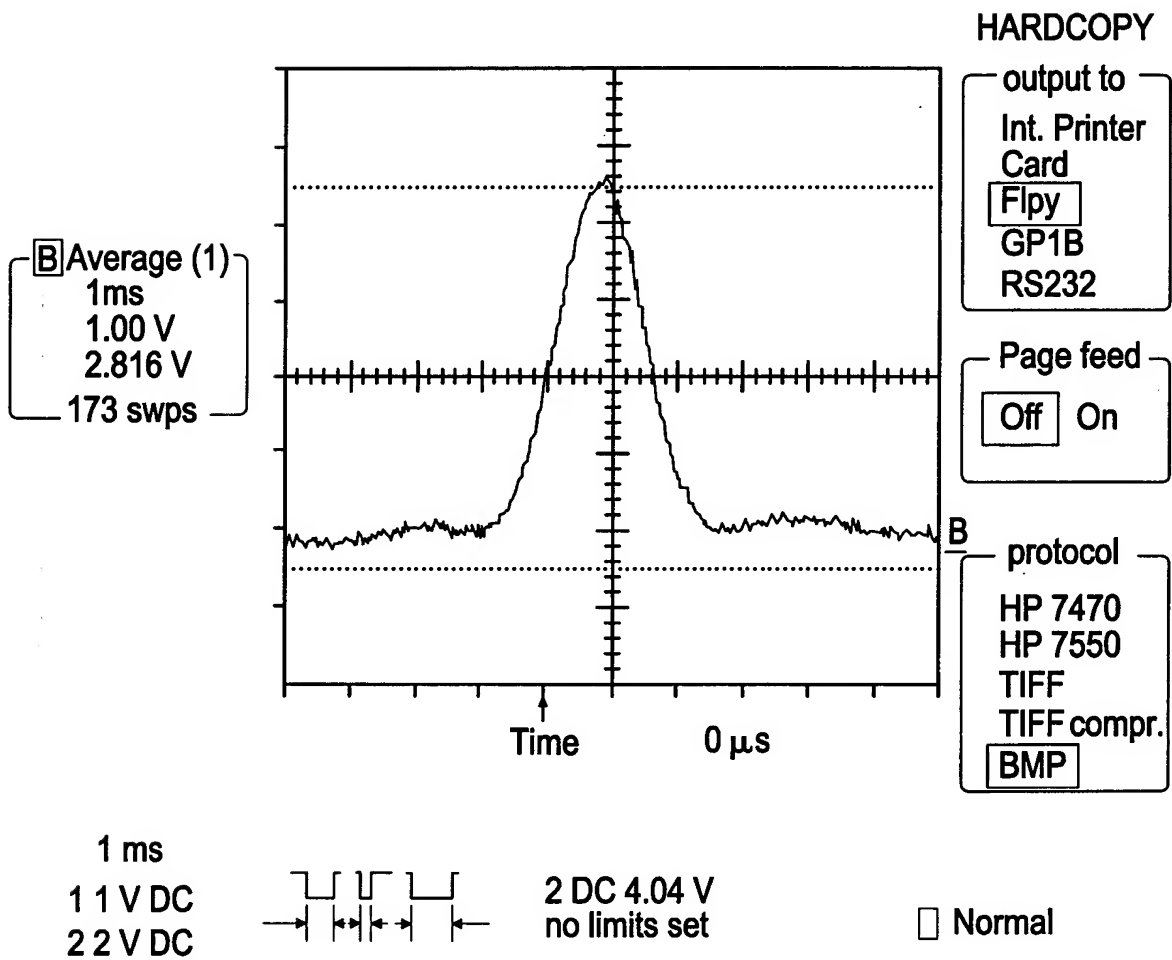
FIG. 10B

Auto correlations of output pulse 50 ps range

HARDCOPY

output to

Int. Printer
Card
Flpy
GPIB
RS232

Page feed

Off On

B protocol

HP 7470
HP 7550
TIFF
TIFF compr.
BMP

B Average (1)
1ms
1.00 V
2.816 V
173 swps

Time   0 μs

1 ms
1 1 V DC
2 2 V DC

2 DC 4.04 V
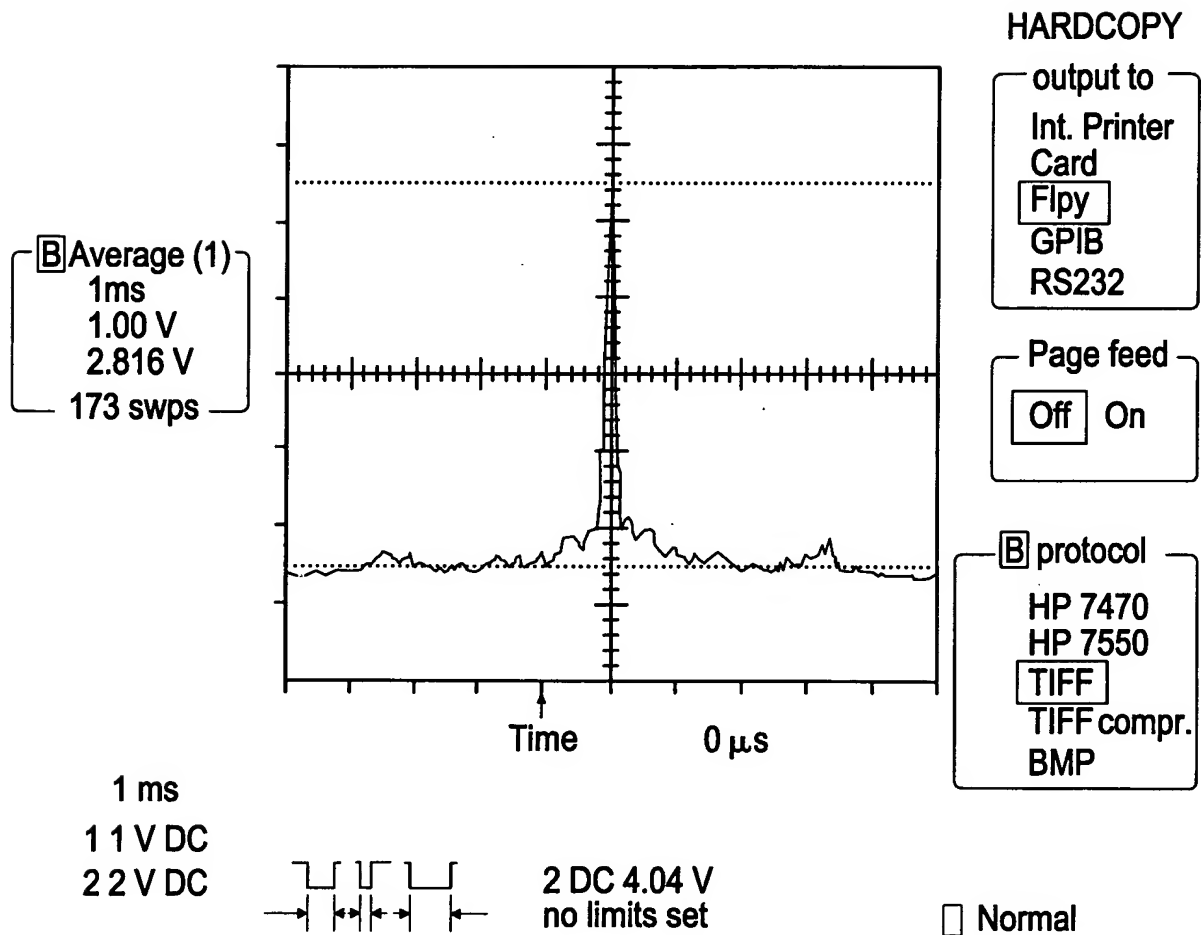no limits set

☐ Normal

FIG. 10C
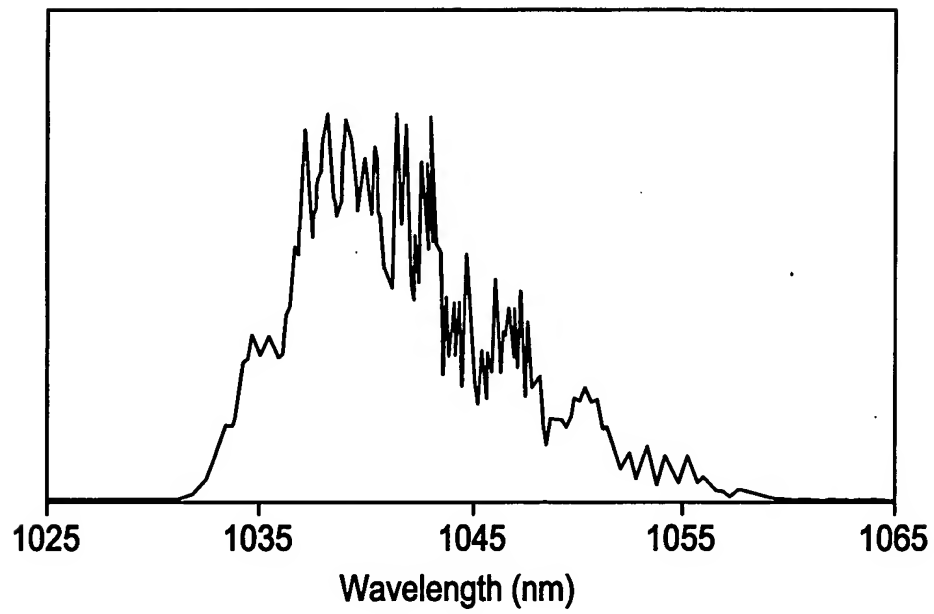
Auto Correlations of Output Pulse Spectrum of Output

Wavelength (nm)

FIG. 11

FCPA block diagram (second embodiment)

FIG. 12A

Spectrum from oscillator

SPECTRAL WIDTH : (THRESHOLD)	MODE FIT: OFF	A:FIX /BLK
THRESH LVL : 3.00dB	Δλ :17.180nm	B:FIX /BLK
K : 1.00 MODE :1	λC :1055.454nm	C:WRITE/DSP

0.105μ W/D   RES:0.2nm SENS:NORM HLDAVG: 1 SMPL:AUTO

AUT REF   AUT ANA   VAC WL
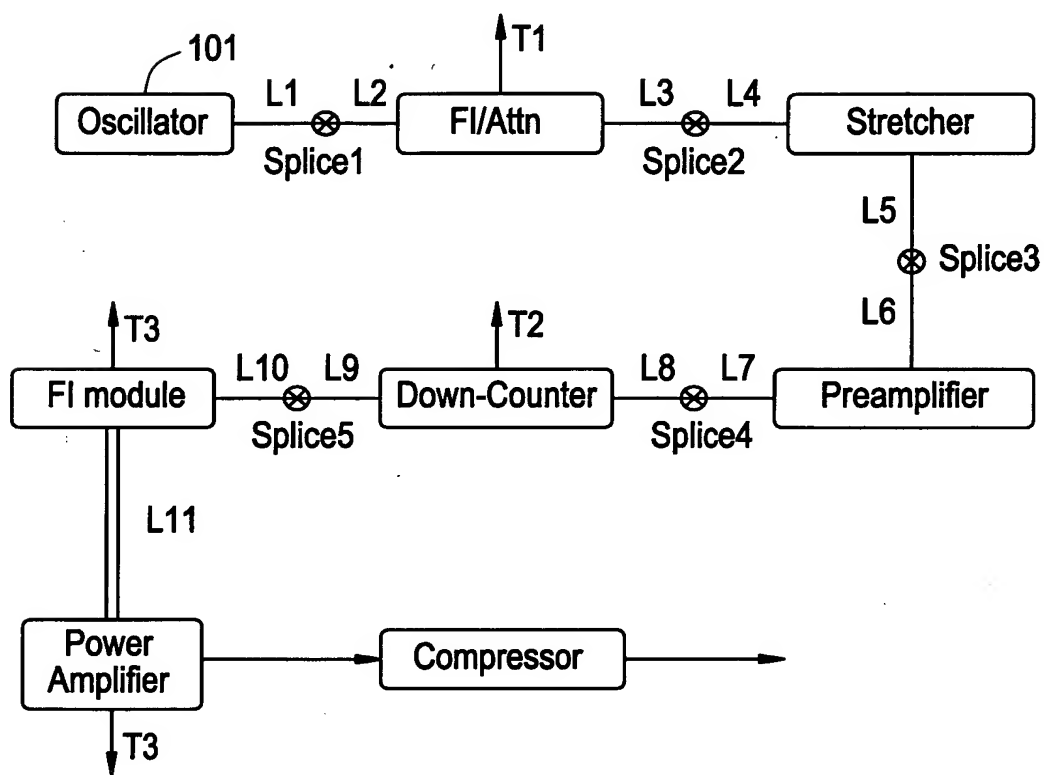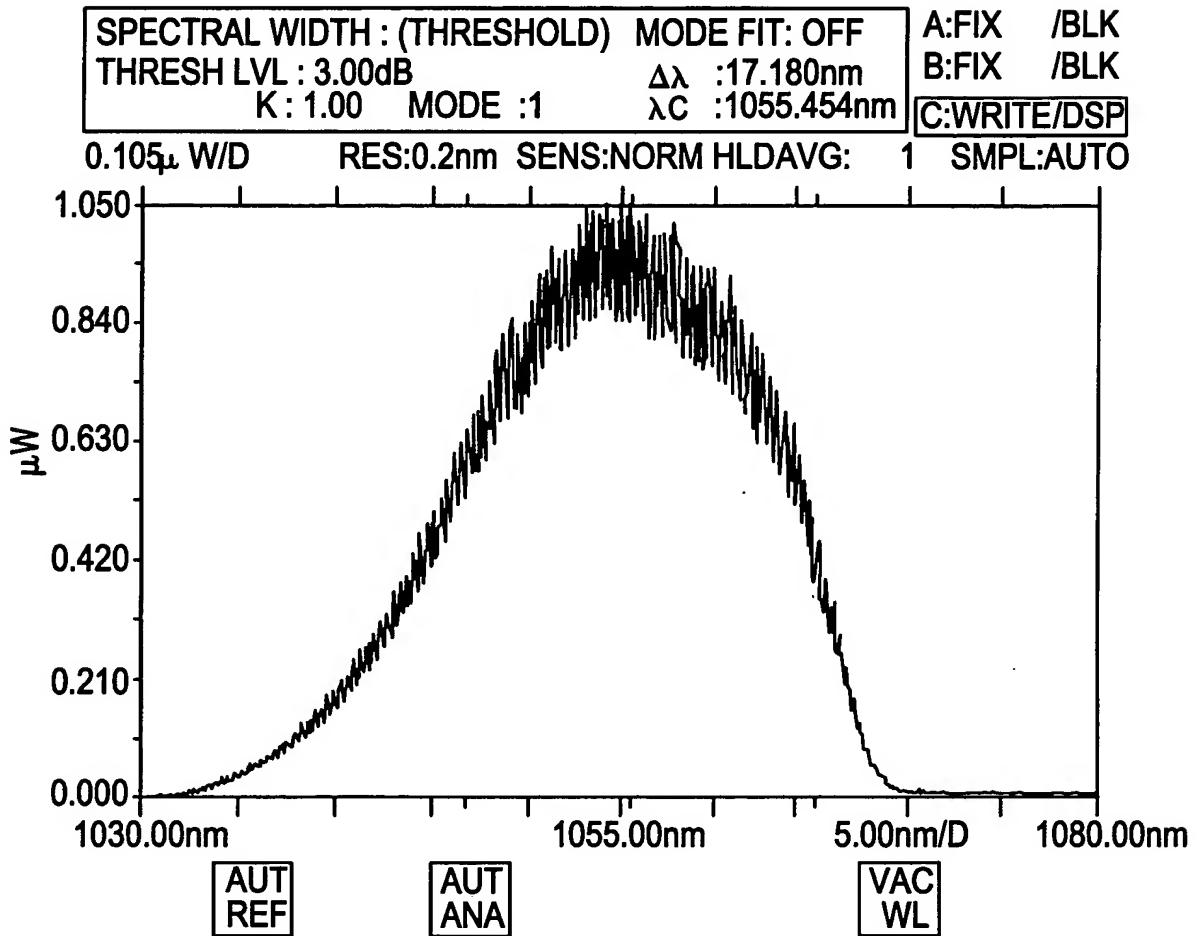
FIG. 12B

Spectrum after filter module

SPECTRAL WIDTH : (THRESHOLD) MODE FIT: OFF	A:FIX /BLK
THRESH LVL : 3.00dB $\Delta\lambda$:11.032nm	B:FIX /BLK
K : 1.00 MODE :1 λC :1051.750nm	C:WRITE /DSP

23.4nW/D   RES:0.2nm   SENS:NORM HLD   AUG: 1 SMPL:AUTO


```
234.0
187.2
nW  140.4
93.6
46.8
0.0
1030.00nm          1055.00nm      5.00nm/D   1080.00nm
```

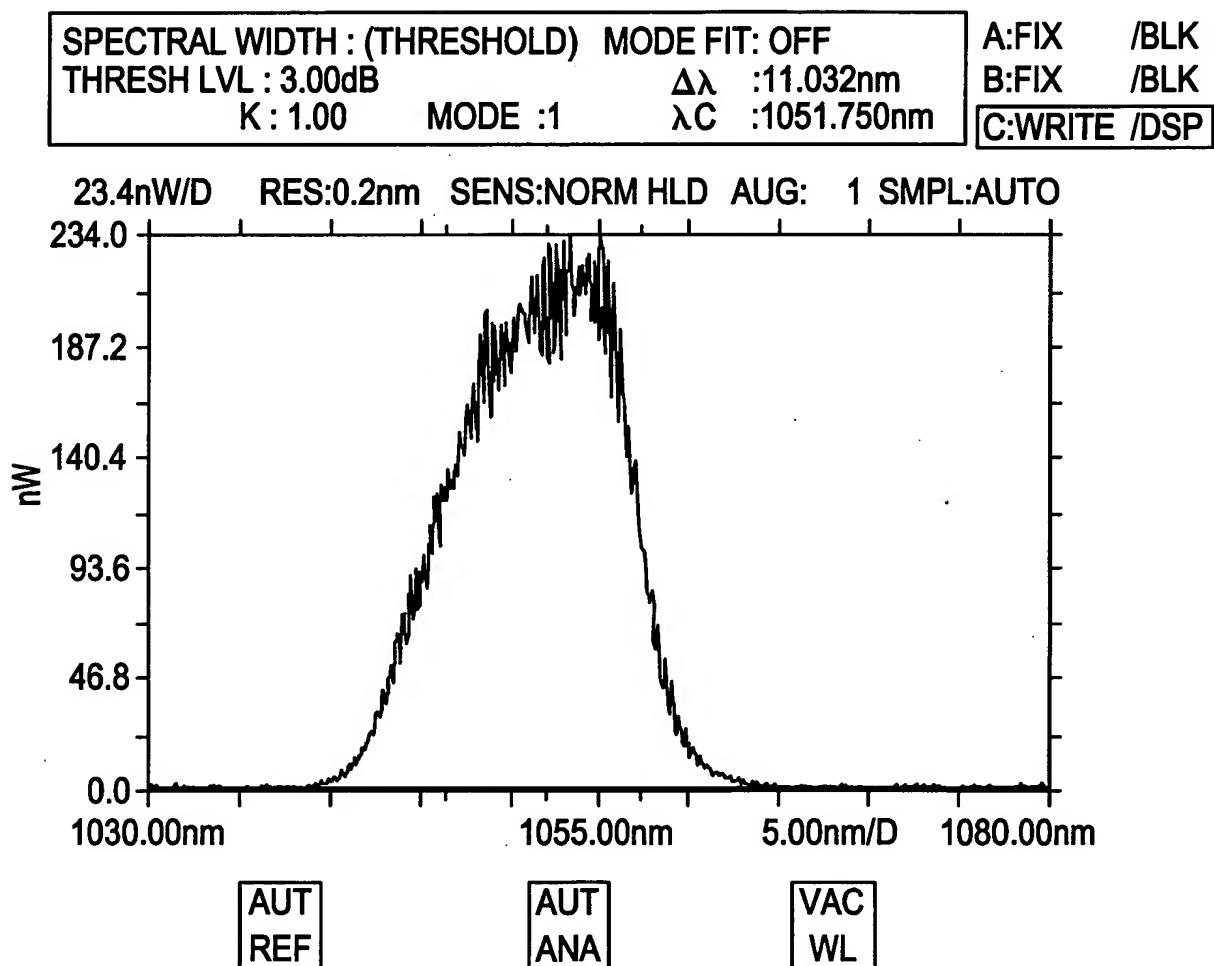| AUT REF | | AUT ANA | | VAC WL |

FIG. 13A

Spectrum after preamplifier

SPECTRAL WIDTH : (THRESHOLD) MODE FIT: OFF	A:FIX /BLK
THRESH LVL : 3.00dB $\Delta\lambda$: 8.854nm	B:FIX /BLK
K : 1.00 MODE : 1 λC :1052.190nm	C:WRITE /DSP

87.7µW/D   RES:0.2nm SENS:NORM HLD AVG: 1 SMPL:AUTO

AUT
REF

AUT
ANA

VAC
WL
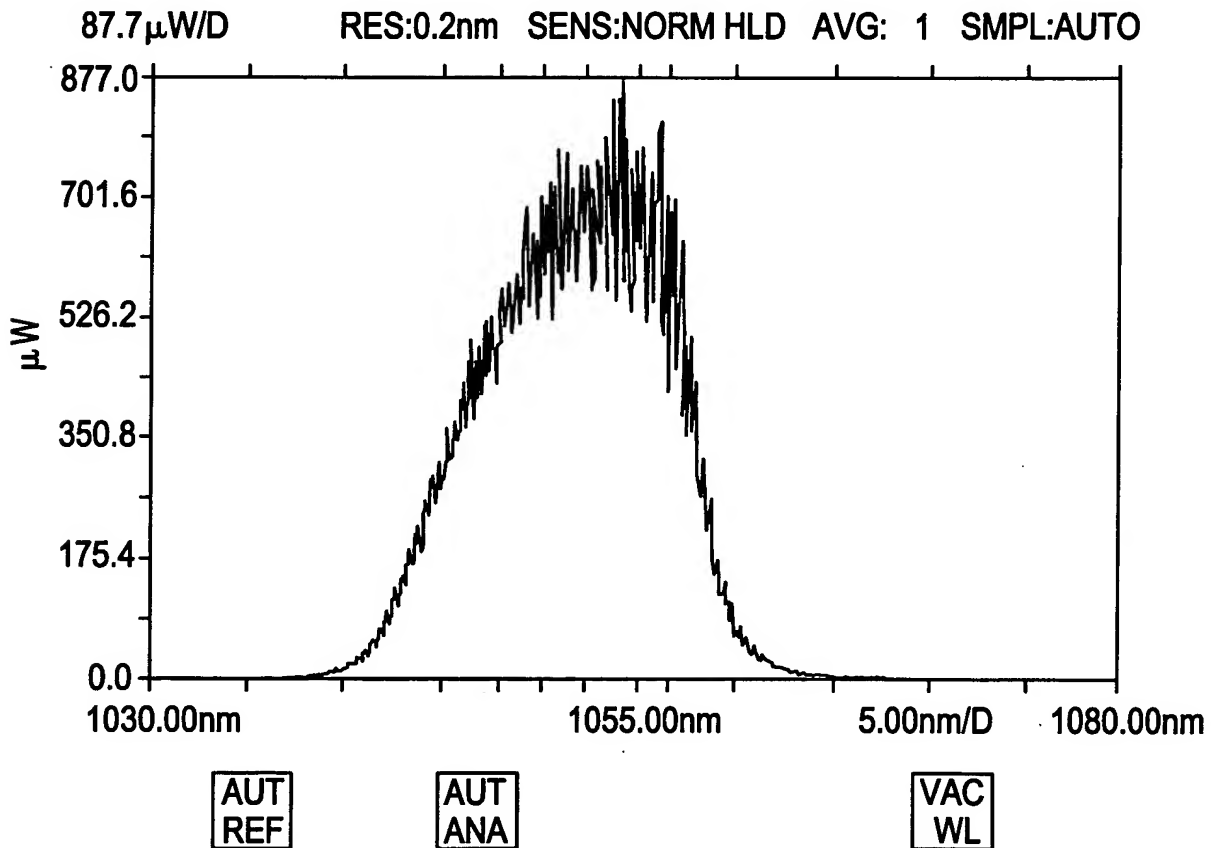
FIG. 13B

Spectrum after power amplifier

Spectrum after power amplifier plot showing intensity vs. Wavelength (nm) from 1020 to 1080 nm, with y-axis labeled 0, 500, 1000, 1500, 2000, 2500, 3000, 4500, 4000, 4500.

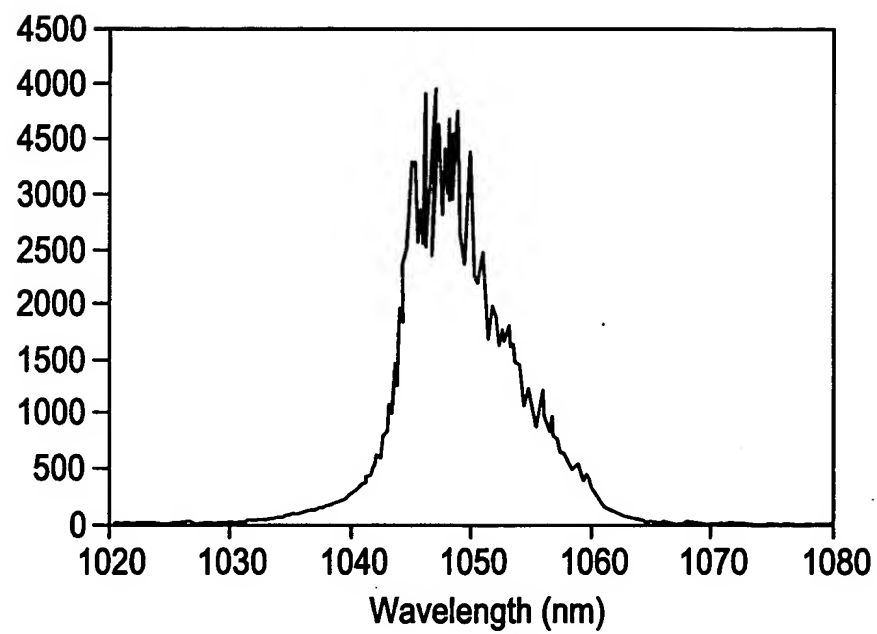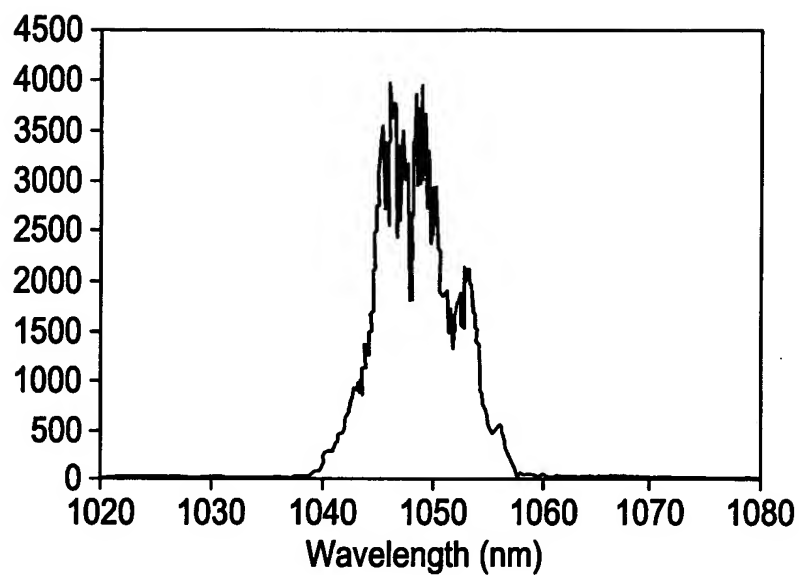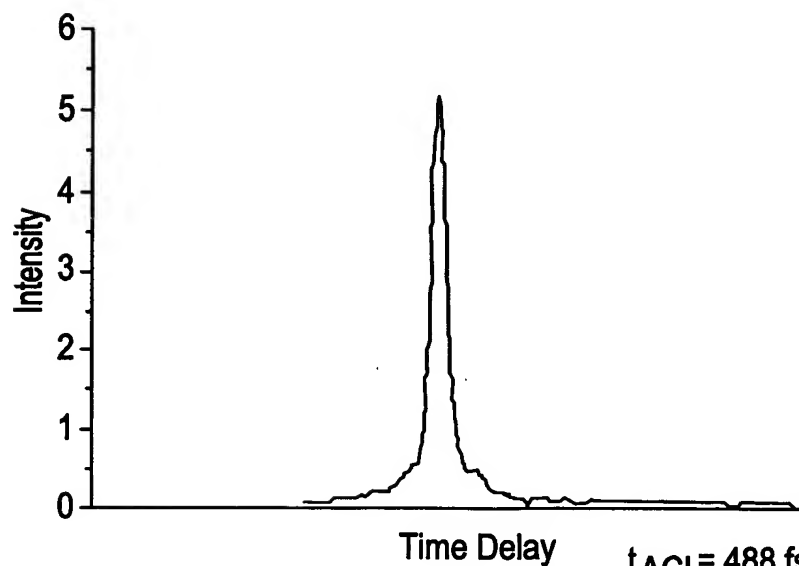# FIG. 14A

Spectrum after compressor

FIG. 14B

Autocorrelation of compressed pulse

t_{ACI} = 488 fs
Pulse width : 345 fs
Assuming Gaussian shape

FIG. 14C
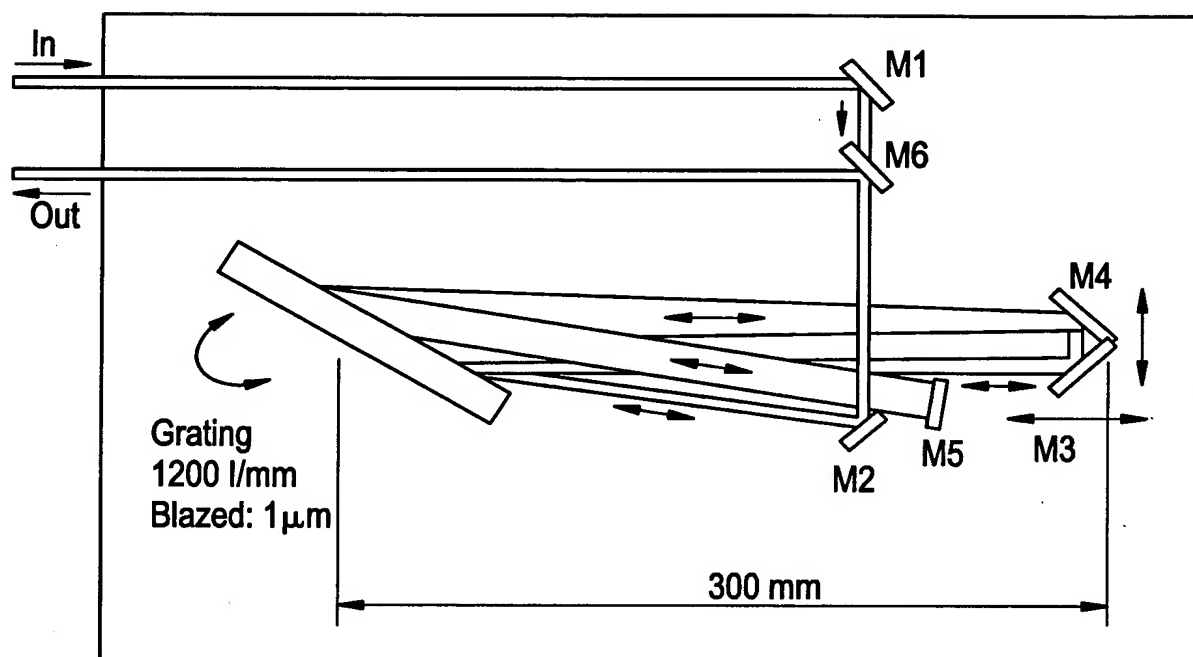

In

Out

M1

M6

M4

M2

M5

M3

Grating
1200 l/mm
Blazed: 1μm

300 mm

FIG. 15

Pump diode
101

20 dB tap
102

Gain fiber
106

Monitor fiber
103

Feedback loop
105

Photo diode
104

FIG. 16

Monitor fiber
103

Gain fiber
106

Pump diode
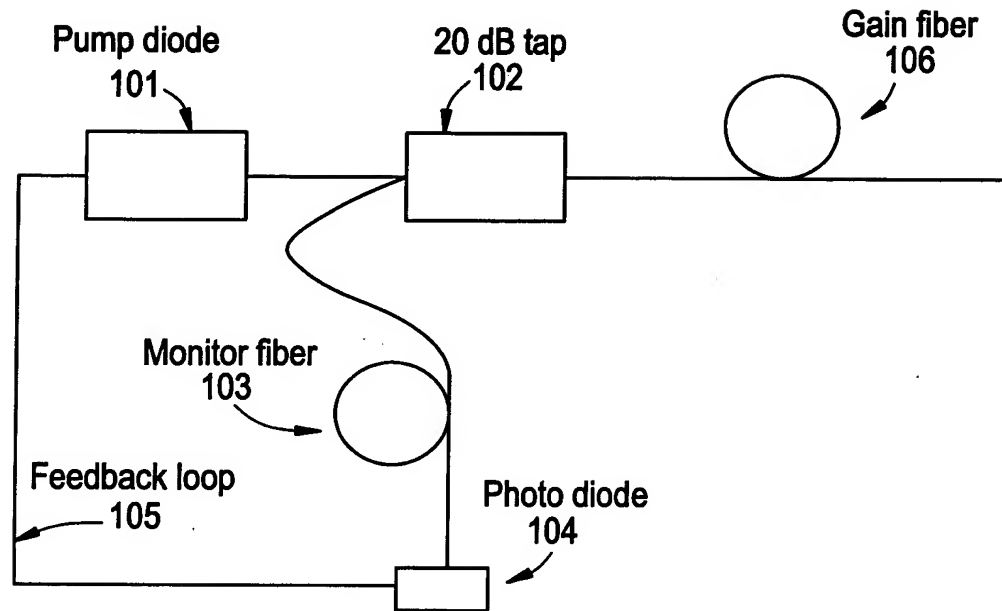101

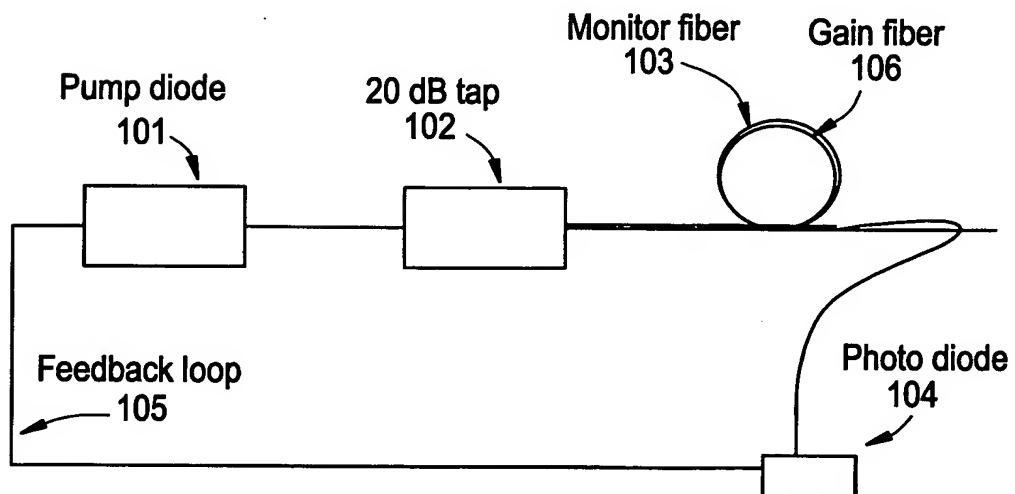20 dB tap
102

Feedback loop
105

Photo diode
104

FIG. 17

Acousto-optic Deflector Illustrating Dispersive Characteristic of Induced
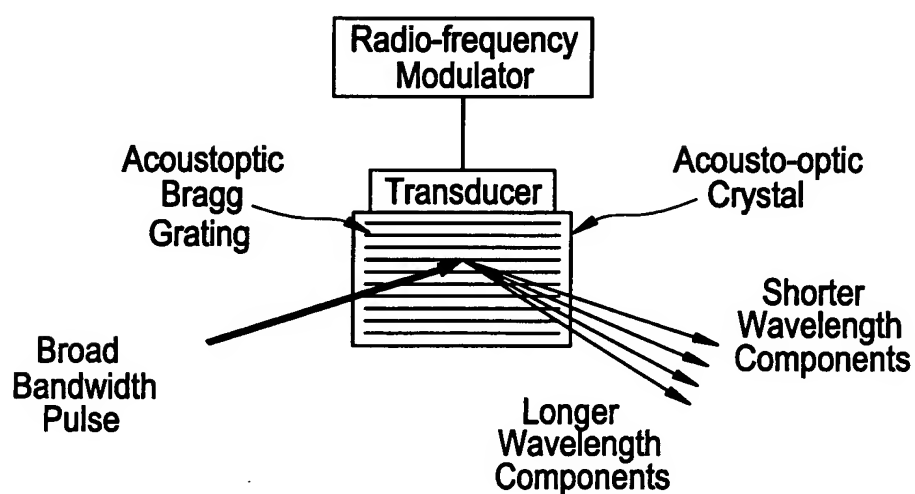Bragg Grating

FIG. 18

Rudimentary Two-pass Chirped-pulse Dispersion-compensated Acousto-
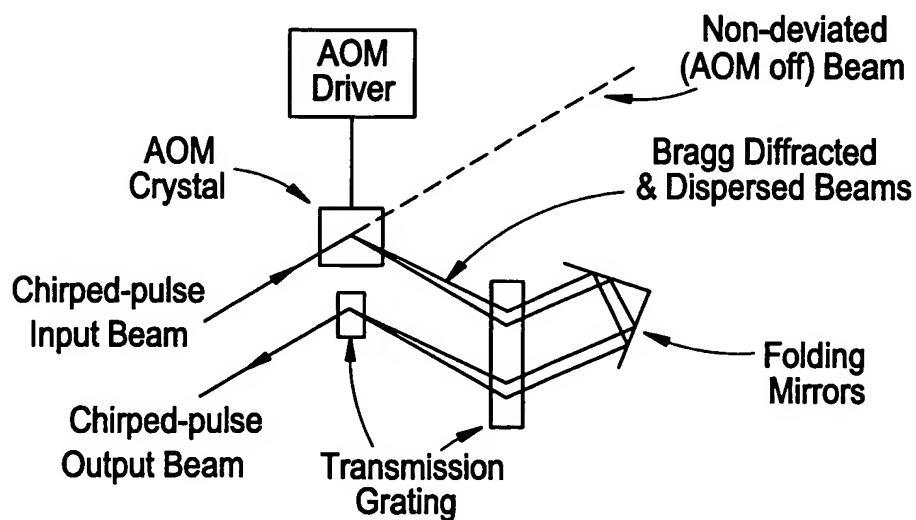optic Switch using Transmission Gratings

FIG. 19

Lens-enhanced Two-pass Chirped-pulse Dispersion-compensated Acousto-optic Switch using Transmission Gratings
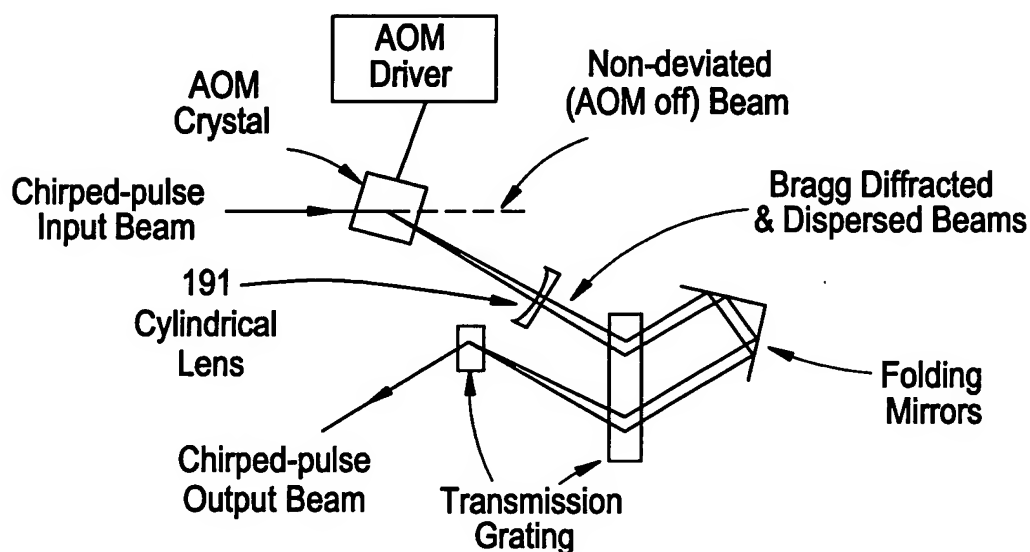

FIG. 20

Lens-enhanced Four-pass Chirped-pulse Dispersion-compensated Acousto-optic Switch using a Reflection Grating